PATENT ABSTRACTS OF JAPAN

(11)Publication number : 11-345019

(43)Date of publication of application : 14.12.1999

(51)Int.Cl. G05B 23/02

(21)Application number : 10-149927

(22)Date of filing : 29.05.1998

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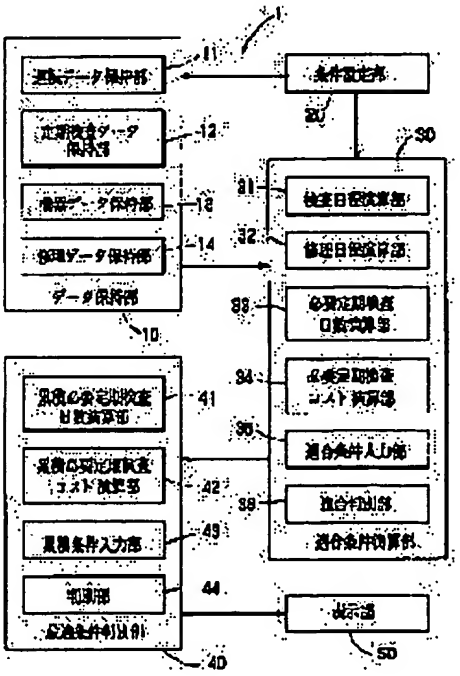
(54) MAINTENANCE SUPPORTING DEVICE FOR PLANT

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a maintenance supporting device for a plant, establishing the long-term maintenance conditions of the plant such as the repair day's schedule of an equipment constituting the plant or the like based on a long-term maintenance schedule.

SOLUTION: This maintenance supporting device 10 for the plant is provided with a data holding part 10 for holding data relating to the plant, a condition setting part 20 for setting the long-term maintenance schedule and a suitable condition computing part 30 for computing suitable maintenance conditions based on the data in the data holding part 10 and the maintenance schedule. The data holding part 10 is provided with an operation data holding part 11 for holding operation data relating to the operation conditions of the plant and a repair data holding part 14 for holding repair data relating to the repair conditions of the equipment constituting the plant. The suitable condition computing part 30 is provided with an inspection day's schedule computing part 31 for setting a periodical inspection day's schedule based on the operation data and the maintenance schedule and a repair day's schedule computing part 32 for setting the repair day's schedule of the equipment constituting the plant based on the repair data and the periodical inspection



day's schedule.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

[JP,11-345019,A]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to plant-maintenance support equipment, and relates to the plant-maintenance support equipment which can calculate plant-maintenance conditions, such as a repair schedule of the device which especially constitutes a plant based on a long-term maintenance program.
[0002]
[Description of the Prior Art] Generally the periodic check of a plant, for example, a power generating plant, is conventionally carried out at intervals of four years. During the periodic check of a plant, a plant is stopped during a fixed period.
[0003] Although it is then fixed when urgent management is required for the facility portion in which failure and fault were discovered by the periodic check, it is usually fixed or updated at the time of a next periodic check. That is, in parallel to inspection of a plant, the repair and updating of a facility portion which discovered fault etc. with the last periodic check are also performed during a periodic check.
[0004]
[Problem(s) to be Solved by the Invention] A plant has many kinds and numbers and does not have few mark of the configuration equipment with which fault etc. is discovered in each periodic check, either. Since the configuration equipment which sets to a next periodic check for every periodic check conventionally, and is fixed and updated is specified, it is difficult to decide upon a long-term maintenance schedule beforehand, for example, the case where the periodic-check period of a continuous periodic check serves as a long period of time which exceeds both 150 days etc. has arisen. I hear that the halt period of a plant becomes long so much, and the periodic check of a plant sometimes attains to a long period of time, and it is not desirable.
[0005] On the other hand, depending on the plant, it decides upon the maintenance schedule about the configuration equipment paying attention to specific configuration equipment, and deciding on the maintenance schedule of an entire plant based on this is also performed. However, since the relation between configuration equipment is not taken into consideration at all, it is difficult to decide on a plant-maintenance schedule which attains to the long period of time of 20 or more.
[0006] Moreover, to decide upon the long-term maintenance schedule of a plant in detail, when managing the cost about maintenance is desired.
[0007] this invention is made in consideration of such a point, and aims at offering the plant-maintenance support equipment which can establish the long-term maintenance conditions of plants, such as a repair schedule of the device which constitutes a plant, based on a long-term maintenance program.
[0008]
[Means for Solving the Problem] The data-hold section holding data concerning [this invention] a plant, and the conditioning section which sets up a long-term maintenance program, It has the compatibility-conditions operation part which calculates the maintenance conditions which suit based on the data held at the data-hold section, and the

maintenance program set as the conditioning section. the data-hold section The performance-data attaching part holding the performance data about plant operation conditions, It has the repair data-hold section holding the repair data about the repair conditions of the device which constitutes a plant. compatibility-conditions operation part The inspection schedule operation part which sets up a periodic-check schedule based on the performance data held at the performance-data attaching part, and the maintenance program set as the conditioning section, It is plant-maintenance support equipment characterized by what it has for the repair schedule operation part which sets up the repair schedule of the device which constitutes a plant based on the repair data held at the repair data-hold section, and the periodic-check schedule which inspection schedule operation part set up.

[0009] Since according to this invention a periodic-check schedule can be set up by the inspection schedule operation part of compatibility-conditions operation part and the repair schedule of the device which constitutes a plant by the repair schedule operation part of compatibility-conditions operation part can be set up, the long-term maintenance conditions of a plant are establishable.

[0010]

[Embodiments of the Invention] Hereafter, the form of operation of this invention is explained with reference to a drawing.

[0011] Drawing 1 is the block diagram showing the form of 1 operation of the plant-maintenance support equipment by this invention. As shown in drawing 1 , plant-maintenance support equipment 1 is equipped with the compatibility-conditions operation part 30 which calculates the maintenance conditions which suit based on the data-hold section 10 holding the data about a plant, the conditioning section 20 which sets up a long-term maintenance program, and the data held at the data-hold section 10 and the maintenance program set as the conditioning section 20.

[0012] The data-hold section 10, the conditioning section 20, and the compatibility-conditions operation part 30 are connected electrically mutually, and transmission and reception of various data are performed. Moreover, the compatibility-conditions operation part 30 is further connected to the optimum-conditions distinction section 40 and the display 50.

[0013] The data-hold section 10 has the performance-data attaching part 11 holding the performance data about plant operation conditions, the periodic-check data-hold section 12 holding the periodic-check data about the schedule of the periodic check of a plant, the equipment-data attaching part 13 holding the equipment data about the kind and the number of a device which constitute a plant, and the repair data-hold section 14 holding the repair data about the repair conditions of the device which constitutes a plant, as shown in drawing 1 .

[0014] In this case, as a performance data held at the performance-data attaching part 11, the future operation plan operating ratio K can be considered to be the accumulation operation time by the plant operation start date, the maintenance-program decision day which uses the form of this operation, and the maintenance-program decision day.

[0015] Among these, the operation plan operating ratio K is a numeric value defined by K= annual operation plan time / 8760. In addition, it is 8760= 24 (time)x365(Sun.). Generally, as for the operation plan operating ratio K, 40% - 80% of range is used.

[0016] Moreover, as periodic-check data about the schedule of the periodic check of the

plant held at the periodic-check data-hold section 12, the periodic-check interval Y and the periodic-check days D can be considered to be the last periodic-check completion dates. In this case, the last periodic check is most near periodic check before establishing plant-maintenance conditions using the form of this operation.

[0017] In the form of this operation, the operation plan operating ratio K is set up for every period corresponding to the periodic-check interval Y, and the operation plan operating ratio K, the periodic-check interval Y, and the periodic-check days D are held in the same database. An example is shown in Table 1 here. As shown in Table 1, generally as for the periodic-check interval Y, the range of the 60th - the 120th will be used in four or less years, as for periodic-check days.

[0018]

[Table 1]

期間番号(i)	運転計画稼働率K(%)	定期検査間隔Y(年)	定期検査日数D(日)
1	60	4	60
2	60	4	80
3	50	4	100
4	50	4	80
5	40	3	120
～	～	～	～
～	～	～	～
n	30	3	80

Moreover, as an equipment data held at the equipment-data attaching part 13, an equipment name M and Number Z can be considered. As an example, the equipment data of the steam turbine of a power generating plant is shown in Table 2.

[0019]

[Table 2]

番号（j）	機器名称（M）	機器個数（Z）
1	主蒸気止め弁	2
2	蒸気加減弁	4
3	複合再熱蒸気弁	2
4	高圧外部車室	1
5	高圧内部車室	1
6	中圧外部車室	1
7	中圧内部車室	1
8	低圧外部車室	2
9	低圧内部車室	2
10	高圧ロータ	1
11	中圧ロータ	1
12	低圧ロータ	1
～	～	～
～	～	～
m	復水器	2

Moreover, as repair data held at the repair data-hold section 14, operation suitable time range Hb-helium (repair implementation suitable time data) about each number of repairs W of the repair item S, and the number of repairs W and each repair item S, the required repair days DN (required repair days data), and the required repair cost C (required repair cost data) can be considered. The general form of the database of repair data is shown in Table 3.

[0020]

[Table 3]

機器名称（Mj）、機器個数（Zj）

修理項目 (Sk)	実施回数 (W)	実施適当時間範囲 (Hbk～Hek)	必要修理日数 (DNk)	必要コスト (Ck)
S1	1回目	Hb1 (1) ～He1 (1)	DN1 (1)	C1 (1)
	2回目	Hb1 (2) ～He1 (2)	DN1 (2)	C1 (2)
	3回目	Hb1 (3) ～He1 (3)	DN1 (3)	C1 (3)
	〃	〃 〃	〃	〃
	10回目	Hb1 (10) ～He1 (10)	DN1 (10)	C1 (10)
S2	1回目	Hb2 (1) ～He2 (1)	DN2 (1)	C2 (1)
	2回目	Hb2 (2) ～He2 (2)	DN2 (2)	C2 (2)
	3回目	Hb2 (3) ～He2 (3)	DN2 (3)	C2 (3)
	〃	〃 〃	〃	〃
	10回目	Hb2 (10) ～He2 (10)	DN2 (10)	C2 (10)
S3	1回目	Hb3 (1) ～He3 (1)	DN3 (1)	C3 (1)
	2回目	Hb3 (2) ～He3 (2)	DN3 (2)	C3 (2)
	3回目	Hb3 (3) ～He3 (3)	DN3 (3)	C3 (3)
	〃	〃 〃	〃	〃
	10回目	Hb3 (10) ～He3 (10)	DN3 (10)	C3 (10)
S4	1回目	Hb4 (1) ～He4 (1)	DN4 (1)	C4 (1)
	2回目	Hb4 (2) ～He4 (2)	DN4 (2)	C4 (2)
	3回目	Hb4 (3) ～He4 (3)	DN4 (3)	C4 (3)
	〃	〃 〃	〃	〃
	10回目	Hb4 (10) ～He4 (10)	DN4 (10)	C4 (10)
〃	〃	〃 〃	〃	〃
	〃	〃 〃	〃	〃
	〃	〃 〃	〃	〃
Sℓ	1回目	Hbℓ (1) ～Heℓ (1)	DNℓ (1)	Cℓ (1)
	2回目	Hbℓ (2) ～Heℓ (2)	DNℓ (2)	Cℓ (2)
	3回目	Hbℓ (3) ～Heℓ (3)	DNℓ (3)	Cℓ (3)
	〃			
	10回目	Hbℓ (10) ～Heℓ (10)	DNℓ (10)	Cℓ (10)

The repair item S is a concrete item of maintenance services, such as general check, precision check, and life-estimation check, a parts replacement, functional recovery repair, and exchange made from one set new, here. Generally, a repair item is 20-30 items by one device. Moreover, generally about 10 times of a number of repairs are the highest about each repair item.

[0021] Moreover, operation suitable time range Hb-helium is the range of the accumulation operation time from a suitable plant operation opening day to carry out the repair item of the number of repairs, Hb is the minimum operation time and helium is the

maximum operation time. Operation suitable time range Hb-helium is set up so that the range for every number of repairs may not overlap about the same repair item.
[0022] As an example, the repair data about high-pressure Rota of a steam turbine are shown in Table 4.
[0023]
[Table 4]

機器名称：高圧ロータ（M10）、機器個数：1（Z10）

修理項目	実施回数（回目）	実施適当時間範囲（万Hr）	必要修理日数（日）	必要コスト（相対値）
一般点検	1回目	3.0～4.0	60	1.0
	2回目	5.0～6.0	60	1.0
	3回目	7.0～8.0	60	1.0
	4回目	11.0～12.0	60	1.0
	5回目	13.0～14.0	60	1.0
	6回目	17.0～18.0	60	1.0
精密点検	1回目	9.0～10.0	70	3.0
	2回目	15.0～16.0	70	3.0
	3回目	19.0～20.0	70	3.0
	4回目	21.5～22.5	70	3.0
寿命診断	1回目	9.0～10.0	70	3.0
	2回目	15.0～16.0	70	3.0
	3回目	19.0～20.0	70	3.0
中心孔検査	1回目	9.0～11.0	80	5.0
	2回目	16.0～18.0	80	5.0
カップリングボルト修理	1回目	9.0～10.0	60	10.0
	2回目	18.0～19.0	60	10.0
高温羽根交換	1回目	8.0～9.0	90	50.0
	2回目	16.0～17.0	90	50.0
曲り修正加工	1回目	14.0～15.0	100	40.0
新製交換	1回目	20.0～23.0	70	100.0

Next, the conditioning section 20 is explained. As for the conditioning section 20, the plan life TY of a plant and the plan durable time TH of a plant are set up as a maintenance program. For example, an input setup of the numeric value as shown in Table 5 is carried out.
[0024]
[Table 5]

計画耐用年数（TY）	60年
計画耐用時間（TH）	300,000時間

Next, the compatibility-conditions operation part 30 is explained. The inspection schedule operation part 31 which sets up a periodic-check schedule based on the performance data held at the performance-data attaching part 11, and the maintenance program set as the conditioning section 20 as the compatibility-conditions operation part

30 is shown in drawing 1 , Based on the repair data held at the repair data-hold section 14, and the periodic-check schedule which the inspection schedule operation part 31 set up, it has the repair schedule operation part 32 which sets up the repair schedule of the device which constitutes a plant.

[0025] The required periodic-check days operation part 33 which furthermore calculates the required periodic-check days for every periodic check based on the required repair days (required repair days data) for every device which constitutes the plant where the compatibility-conditions operation part 30 was held at the repair data-hold section 14, The required periodic-check cost operation part 34 which calculates the required periodic-check cost for every periodic check based on the required repair cost (required repair cost data) for every device which constitutes the plant held at the repair data-hold section 14, It has the compatibility-conditions input section 35 which inputs the compatibility conditions to required periodic-check days and required periodic-check cost, and the conformity distinction section 36 which distinguishes the maintenance conditions which suit compatibility conditions based on required periodic-check days and required periodic-check cost.

[0026] Next, the optimum-conditions distinction section 40 and a display 50 are explained. The accumulation required inspection days operation part 41 which the optimum-conditions distinction section 40 carries out the accumulation operation of the required periodic-check days for every periodic check which the required periodic-check days operation part 33 calculated, and calculates accumulation required periodic-check days, The accumulation required periodic-check cost operation part 42 which carries out the accumulation operation of the required periodic-check cost for every periodic check which the required periodic-check cost operation part 34 calculated, and calculates accumulation required periodic-check cost, It has the accumulation condition input section 43 which inputs the accumulation conditions over accumulation required periodic-check days and accumulation required periodic-check cost, and the distinction section 44 which distinguishes the maintenance conditions which suit accumulation conditions based on accumulation required periodic-check days and accumulation required periodic-check cost. Moreover, a display 50 displays various kinds of results of an operation and distinction results of the compatibility-conditions operation part 30 and the optimum-conditions distinction section 40.

[0027] Next, an operation of the form of this operation which consists of such composition is explained. The data shown in the aforementioned Table 1, 2, and 4 are set up and held first at the performance-data attaching part 11 of the data-hold section 10, the periodic-check data-hold section 12, the equipment-data attaching part 13, and the repair data-hold section 14. In addition, as a maintenance-program decision day, January 1, 1998 is set up and held, and 20,000 hours is set up and held as accumulation operation time by the maintenance-program decision day at the performance-data attaching part 11.

[0028] Next, the data shown in the aforementioned table 5 are set as the conditioning section 20.

[0029] Next, the inspection schedule operation part 31 of the compatibility-conditions distinction section 30 calculates any reach at an early stage based on the operation plan operating ratio K held at the performance-data attaching part 11 among the plan life TY of the plant set as the conditioning section 20, and the plan durable time TH, and decides those who reach at an early stage as a deadline for a durable maintenance time.

[0030] Furthermore, the inspection schedule operation part 31 calculates and decides on the periodic-check schedule in a durable maintenance time based on the periodic-check interval Y held at the periodic-check data-hold section 12, and the periodic-check days D.
[0031] In the case of the data shown in Table 1 and 5, the deadline for a durable maintenance time is decided by the plan life TY, and as shown in Table 6, it decides on a periodic-check schedule.
[0032]
[Table 6]

項　　目	年・月・日	運転時間 (Hr)	稼働率 K(%)	定期検査 間隔Y(年)	定期検査 日数D(日)
運転開始年月日	1990- 1- 1				
前回定期検査完了	1995- 1- 1	20.000			
保守計画策定開始	1998- 1- 1				
1回目定期検査開始	2001- 1- 1	51.536	60	6	60
1回目定期検査完了	2001- 3- 1				
2回目定期検査開始	2006- 3- 1	77.816	60	5	60
2回目定期検査完了	2006- 5- 1				
3回目定期検査開始	2010- 5- 1	95.336	50	4	120
3回目定期検査完了	2010- 9- 1				
4回目定期検査開始	2014- 9- 1	112.856	50	4	60
4回目定期検査完了	2014-11- 1				
5回目定期検査開始	2018-11- 1	130.376	50	4	60
5回目定期検査完了	2019- 1- 1				
6回目定期検査開始	2023- 1- 1	147.896	50	4	120
6回目定期検査完了	2023- 5- 1				
7回目定期検査開始	2027- 5- 1	165.416	50	4	90
7回目定期検査完了	2027- 8- 1				
8回目定期検査開始	2031- 8- 1	179.432	40	4	60
8回目定期検査完了	2031-10- 1				
9回目定期検査開始	2035-10- 1	193.448	40	4	120
9回目定期検査完了	2036- 2- 1				
10回目定期検査開始	2040- 2- 1	207.464	40	4	90
10回目定期検査完了	2040- 5- 1				
11回目定期検査開始	2043- 5- 1	217.976	40	3	90
11回目定期検査完了	2043- 8- 1				
12回目定期検査開始	2046- 8- 1	228.488	40	3	120
12回目定期検査完了	2046-12- 1				
13回目定期検査開始	2048-12- 1	235.496	40	2	60
13回目定期検査完了	2049- 2- 1				
計画耐用年数完了	2050- 1- 1	238.708	40		

Then, the repair schedule operation part 32 sets up the repair schedule of the device which constitutes a plant based on the repair data held at the repair data-hold section 14 especially operation suitable time range Hb-helium, and the periodic-check schedule which the inspection schedule operation part 31 set up. That is, a periodic-check schedule which serves as accumulation operation-time <=helium of the plant at the time of Hb<= periodic check is chosen as each repair schedule. When the range of operation suitable time range Hb-helium is large, two or more periodic-check schedules may be chosen. In this case, it holds as a repair schedule which suits on condition that all the pattern case of

them.
[0033] Furthermore, the repair schedule operation part 23 holds the maximum of the required periodic-check days of the repair item carried out in each periodic check about the held aforementioned repair schedule, and distinguishes whether it goes into the range of the periodic-check days D of the periodic check concerned. If it is within the limits, it will consider as the schedule which suits conditions, and if out of range, it will consider as the schedule besides a condition.
[0034] Then, based on the required repair days of each repair item, the required periodic-check days for every periodic check calculate by the required periodic-check days operation part 33, and the required periodic-check cost for every periodic check calculates by the required periodic-check cost operation part 34 based on the required repair cost of each repair item. Required periodic-check days are the maximum of the required repair days of the repair item in the periodic check concerned. Required periodic-check cost is the required repair cost, when the repair item in the periodic check concerned is single, and when a repair item is plurality, it is simply calculated by predetermined method which serves as a small value from the sum of required repair cost according to not the sum but the actual condition of those required repair costs.
[0035] In addition, you may input the compatibility conditions to required periodic-check days and required periodic-check cost into the compatibility-conditions input section 35. In this case, the maintenance conditions which suit compatibility conditions based on required periodic-check days and required periodic-check cost by the comprehensive distinction section 36 are distinguished.
[0036] Then, the accumulation required inspection days operation part 41 carries out the accumulation operation of the required periodic-check days, and calculates accumulation required periodic-check days, and the accumulation required periodic-check cost operation part 42 carries out the accumulation operation of the required periodic-check cost, and calculates accumulation required periodic-check cost.
[0037] On the other hand, the accumulation conditions over accumulation required periodic-check days and accumulation required periodic-check cost are inputted into the accumulation condition input section 43, and the maintenance conditions which suit accumulation conditions based on accumulation required periodic-check days and accumulation required periodic-check cost by the distinction section 44 are distinguished.
[0038] Then, a display 50 displays various kinds of results of an operation and distinction results of the compatibility-conditions operation part 30 and the optimum-conditions distinction section 40. In addition, when required periodic-check days are shorter than the periodic-check days set up at the beginning, you may pack a schedule.
[0039] If it explains using an example, in the case of the periodic-check schedule shown in the repair data and Table 6 showing in Table 3, a repair schedule as shown in Table 7 by the repair schedule operation part 23 will be set up. In addition, about the 1st repair schedule of general check, since the operation suitable time range is already passed at the maintenance-program decision time, it is ignored.
[0040]
[Table 7]

機器名称：高圧ロータ（M10）、機器個数：1（Z10）　修理データ：図5に示す。　運用時間：図6に示す。

修理項目	実施周期 (W)	定期検査回数（I）												
		1回目	2回目	3回目	4回目	5回目	6回目	7回目	8回目	9回目	10回目	11回目	12回目	13回目
一般点検	1回目													
	2回目	○												
	3回目		○											
	4回目				○									
	5回目					○								
	6回目								○	○				
精密点検	1回目			○										
	2回目						○	○						
	3回目										○			
	4回目												○	○×
寿命診断	1回目			○										
	2回目						○	○						
	3回目										○			
中心孔検査	1回目			○										
	2回目							○	○×	○				
カップリングボルト修理	1回目			○										
	2回目								○	○				
高速羽根交換	1回目			○										
	2回目							○						
曲り修正加工	1回目						○							
新規交換	1回目											○	○	○×

As shown in O mark of Table 7, the 6th time of general check suits two periodic-check schedules, and the 2nd time of precision check and the 4th time are selectable in two periodic-check schedules respectively. The 2nd time of life estimation is selectable in two periodic-check schedules, the 2nd time of feed-hole inspection is selectable in three periodic-check schedules, the 2nd time of distributor-shaft-coupling bolt repair is selectable in two periodic-check schedules, and the 1st time of the exchange made from new is selectable in three periodic-check schedules. For this reason, the pattern case of all such combination, i.e., the repair schedule pattern case of 2x2x2x2x3x2x3=288, is held as a schedule which suits conditions.

[0041] Next, it is distinguished whether by the repair schedule operation part 23, the maximum of the required periodic-check days DN of the repair item S carried out in each periodic check about the repair schedule pattern case of 288 was held, and it goes into the range of the periodic-check days D of the periodic check concerned. Selection of the repair schedule shown in Table 7 by x mark by this distinction becomes impossible, and the pattern case left behind as a schedule which suits conditions turns into a 2x2x2x2x2x2=64 pattern case.

[0042] About the repair schedule of the pattern case of 64 based on Table 7, the extract of required periodic-check days and accumulation required periodic-check days is shown in Table 8.

[0043]

[Table 8]

機器名称：高圧ロータ（M10）、機器個数：1（Z10）

必要定期検査	定期検査回数（i）												
日数（DN）	1回目	2回目	3回目	4回目	5回目	6回目	7回目	8回目	9回目	10回目	11回目	12回目	13回目
ケース（1）	60	60	90	60	60	100	90	60	0	70	70	70	0
累積日数	60	120	210	270	330	430	520	580	580	650	720	790	790
ケース（2）	60	60	90	60	60	100	90	60	0	70	0	70	0
累積日数	60	120	210	270	330	430	520	580	580	650	650	720	720
ケース（3）	60	60	90	60	60	100	90	60	60	70	70	70	0
累積日数	60	120	210	270	330	430	520	580	640	710	780	850	850
ケース（4）	60	60	90	60	60	100	90	60	60	70	0	70	0
累積日数	60	120	210	270	330	430	520	580	640	710	710	780	780
｜	｜	｜	｜	｜	｜	｜	｜	｜	｜	｜	｜	｜	｜
｜	｜	｜	｜	｜	｜	｜	｜	｜	｜	｜	｜	｜	｜
ケース(64)	60	60	90	60	60	100	90	0	80	70	0	70	0
累積日数	60	120	210	270	330	430	520	520	600	670	670	740	740

Next, about the repair schedule sorted out about another device, required periodic-check days and accumulation required periodic-check days are shown in Table 9, and required periodic-check cost and accumulation required periodic-check cost are shown in Table 10.

[0044]

[Table 9]

必要定期検査	定期検査回数（i）												
日数（DN）	1回目	2回目	3回目	4回目	5回目	6回目	7回目	8回目	9回目	10回目	11回目	12回目	13回目
ケース（1）	60	60	90	90	120	60	60	90	120	90	90	90	90
累積日数	60	120	210	300	420	480	540	630	750	840	930	1020	1110
ケース（2）	60	60	60	120	120	60	60	90	90	120	120	90	90
累積日数	60	120	180	300	420	480	540	630	720	840	960	1050	1140
ケース（3）	60	60	60	150	60	60	90	90	150	60	60	90	90
累積日数	60	120	180	330	390	450	540	630	880	940	1000	1090	1180
ケース（4）	60	60	60	90	120	120	60	90	90	120	90	60	90
累積日数	60	120	180	270	390	510	570	630	720	840	930	990	1080
｜	｜	｜	｜	｜	｜	｜	｜	｜	｜	｜	｜	｜	｜
｜	｜	｜	｜	｜	｜	｜	｜	｜	｜	｜	｜	｜	｜
ケース（n）	60	60	90	90	90	150	60	60	90	90	120	60	60
累積日数	60	120	210	300	390	540	600	660	750	840	960	1020	1080

[0045]

[Table 10]

必要コスト	定期検査回数 (i)												
(C)	1回目	2回目	3回目	4回目	5回目	6回目	7回目	8回目	9回目	10回目	11回目	12回目	13回目
ケース (1)	1	3	5	1	8	10	5	55	41	3	100	1	3
累積コスト	1	4	9	10	18	28	33	88	129	132	232	233	236
ケース (2)	1	3	8	3	5	15	55	10	41	3	5	100	1
累積コスト	1	4	12	15	20	35	90	100	141	144	149	249	250
ケース (3)	1	3	5	10	6	10	3	96	3	100	1	3	3
累積コスト	1	4	9	19	24	34	37	133	136	236	237	240	243
ケース (4)	1	3	6	5	5	5	100	41	3	100	1	3	3
累積コスト	1	4	9	14	19	24	124	165	168	268	269	270	273
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
ケース (n)	1	3	5	3	3	41	5	100	1	10	5	50	5
累積コスト	1	4	9	12	15	56	61	161	162	172	177	227	232

About the repair schedule of this another device, need periodic-check days <=150 and required periodic-check cost <=100** are inputted into the compatibility-conditions input section 35 for every periodic check as compatibility conditions to required periodic-check days and required periodic-check cost. Moreover, accumulation need periodic-check days <=1100 and accumulation required periodic-check cost <=250** are inputted into the accumulation condition input section 43 as compatibility conditions to accumulation required periodic-check days and accumulation required periodic-check cost. The pattern case n shown in Table 9 and 10 which fulfills these conditions is shown in drawing 2 by making various kinds of results of an operation into a graph.

[0046] As mentioned above, according to the form of this operation, a periodic-check schedule can be set up by the inspection schedule operation part 31, and since the repair schedule of the device which constitutes a plant by the repair schedule operation part 32 can be set up, the long-term maintenance schedule of a plant is establishable.

[0047] Moreover, according to the form of this operation, maintenance conditions which agree on the periodic-check schedule set up beforehand can be chosen by taking into consideration the required repair days of each repair item. Moreover, by taking into consideration the required repair days and required repair cost of each repair item, the maintenance conditions for which were more suitable can be chosen.

[0048] Moreover, according to the form of this operation, by the optimal distinction section 44, since accumulation required periodic-check days and accumulation required repair cost are taken into consideration, the maintenance conditions for which were more suitable can be chosen.

[0049] Since the maintenance time is furthermore established in consideration of a plan life and plan durable time according to the form of this operation, the reliability of a maintenance time and maintenance conditions is high.

[0050]

[Effect of the Invention] According to this invention, the long-term maintenance conditions of a plant are establishable as mentioned above.

[Translation done.]